CLAIMS

1. A method for desymmetrization, comprising:

providing a catalyst and a molecular substrate having a plane of symmetry, the catalyst being present in an amount of less than 15 mol%, relative to an amount of substrate; and

causing an olefin metathesis reaction involving the molecular substrate to occur to form a product free of a plane of symmetry.

2. Cancelled.

3. A method as in claim 1, wherein the molecular substrate is selected from the group consisting of achiral and meso substrates.

4. A method as in claim 1, wherein the molecular substrate is selected from the group consisting of cyclic and acyclic substrates.

5. A method as in claim 1, wherein the product is selected from the group consisting of cyclic and acyclic products.

6. A method as in claim 1, wherein the product includes at least one ring having a ring size of less than about 20 atoms.

7. A method as in claim 1, wherein the product includes at least one ring having a ring size of less than about 10 atoms.

8. Cancelled.

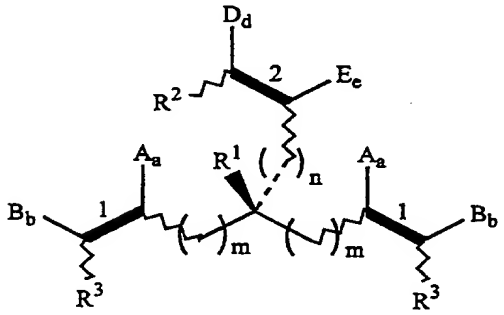
9. A method as in claim 1, wherein the catalyst is present in an amount of less than about 10 mol%.

10. A method as in claim 1, wherein the catalyst is present in an amount of less than about

5 % mol.

11. A method as in claim 1, wherein the catalyst is present in an amount of less than about 1 mol%.

12. A method as in claim 1, wherein the molecular substrate comprises a structure:

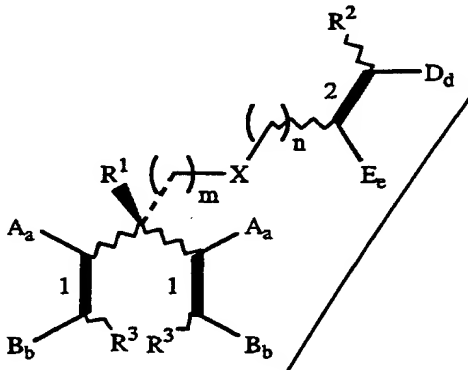


wherein "1 ▌" and 2▌" can be the same or different and each of "1▌" and "2▌" denotes a bond selected from the group consisting of a double bond and a triple bond; a, b, d, and e can be the same or different and each of a, b, d and e is an integer equaling 0 to 1; m and n can be the same or different and each of m and n are integers equaling 0-20; A, B, D, E and R^1 - R^3 can be the same or different and each of A, B, D, E and R^1 - R^3 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

13. A method as in claim 12, wherein each of m and n are integers equaling 0-10.

14. A method as in claim 12, wherein the functional group including at least one non-carbon element is selected from the group consisting of O, S, Se, silane, silyl ether, carbonyl, carboxyl, carboxylate, ether, ester, anhydride, acyl, cyano, NO_2, alkyloxy, aryloxy, hydroxy, hydroxyalkyl, amino, alkylamino, arylamino, amido, thioalkyl, thioaryl, sulfonate, phosphate, phosphonate, phosphane and stannane.

15. A method as in claim 1, wherein the molecular substrate comprises a structure:



B1

Amended claims

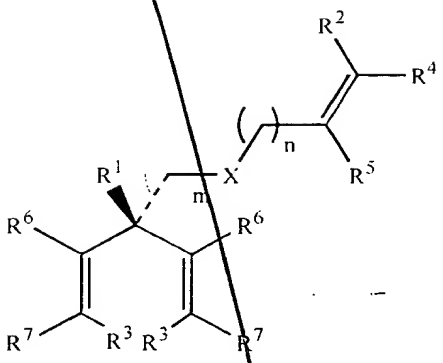
wherein "1 ▌" and "2▌" can be the same or different and each of "1 ▌" and "2▌" denotes a bond selected from the group consisting of a double bond and a triple bond; X is a functional substituent; a, b, d, and e can be the same or different and each of a, b, d and e is an integer equaling 0 to 1; m and n can be the same or different and each of m and n are integers equaling 0-20; A, B, D, E and R^1 - R^3 can be the same or different and each of A, B, D, E and R^1 - R^3 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

16. A method as in claim 15, wherein each of m and n are integers equaling 0-10.

17. A method as in claim 15, wherein the functional group including at least one non-carbon element is selected from the group consisting of O, S, Se, silane, silyl ether, carbonyl, carboxyl, carboxylate, ether, ester, anhydride, acyl, cyano, NO_2, alkyloxy, aryloxy, hydroxy, hydroxyalkyl, amino, alkylamino, arylamino, amido, thioalkyl, thioaryl, sulfonate, phosphate, phosphonate, phosphane and stannane.

18. A method as in claim 15, wherein X is selected from the group consisting of CR^8R^9, carbonyl, ester, SiR^8R^9, $OSi(R^8)(R^9)$, SnR^8R^9, O, S, Se, NR^8, PR^8 and PO_3R^8; R^8 and R^9 can be the same or different and each of R^8 and R^9 is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

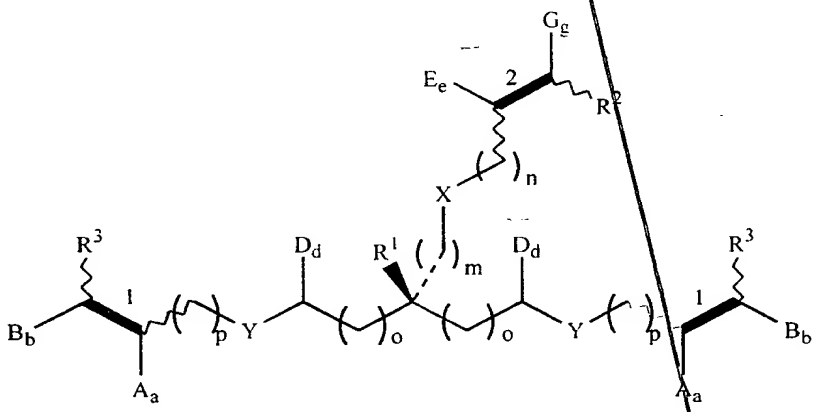
19. A method as in claim 15, wherein the molecular substrate comprises a structure:



wherein R^4 - R^7 can be the same or different and each of R^4 - R^7 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

20. A method as in claim 19, wherein X is selected from the group consisting of CR^8R^9, carbonyl, ester, SiR^8R^9, SiR^8R^9, $OSi(R^8)(R^9)$, SnR^8R^9, O, S, Se, NR^8, PR^8, and PO_3R^8; R^8 and R^9 can be the same or different and each of R^8 and R^9 is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

21. A method as in claim 1, wherein the molecular substrate comprises a structure:



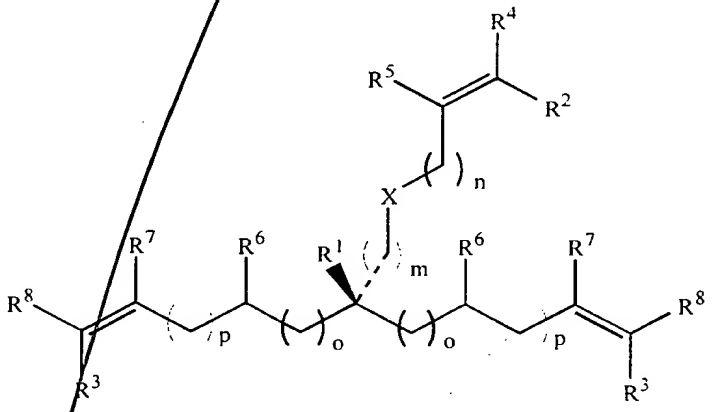
wherein "1 ▌" and "2▌" can be the same or different and each of "1 ▌" and "2▌" denotes a bond selected from the group consisting of a double bond and a triple bond; X and Y can be the same or different and each is a functional substituent; a, b, d, e and g can be the same or different and each of a, b, d, e and g are integers equaling 0 to 1; m, n, o and p can be the

same or different and each of m, n, o and p are integers equaling 0-20; A, B, D, E, G and R^1 - R^3 can be the same or different and each of A, B, D, E, G and R^1 - R^3 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, and C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl, wherein C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

22. A method as in claim 21, wherein each of m and n are integers equaling 0-10.

23. A method as in claim 21, wherein X and Y are selected from the group consisting of CR^9R^{10}, carbonyl, ester, SiR^9R^{10}, $OSi(R^9)(R^{10})$, SnR^9R^{10}, B, O, S, Se, NR^9, PR^9 and PO_3R^9; R^9 and R^{10} can be the same or different and each of R^9 and R^{10} is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

24. A method as in claim 21, wherein the molecular substrate comprises a structure:

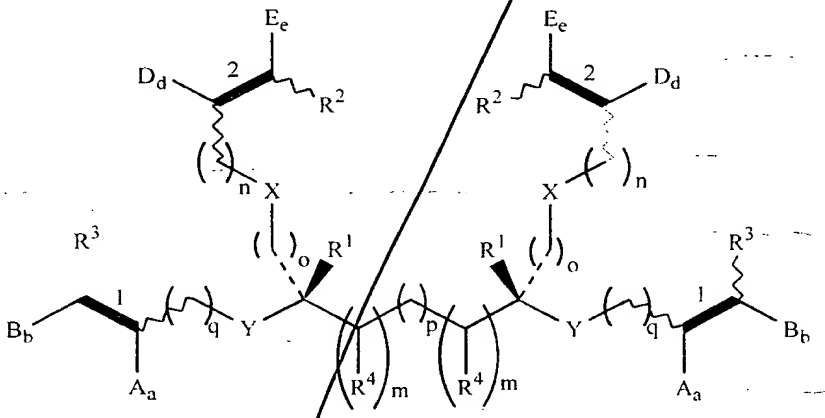


wherein R^4 - R^8 can be the same or different and each of R^4 - R^8 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

25. A method as in claim 24, wherein X is selected from the group consisting of CR^9R^{10}, carbonyl, ester, SiR^9R^{10}, $OSi(R^9)(R^{10})$, SnR^9R^{10}, B, O, S, Se, NR^9, PR^9 and PO_3R^9; R^9 and R^{10}

can be the same or different and each of R^9 and R^{10} is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

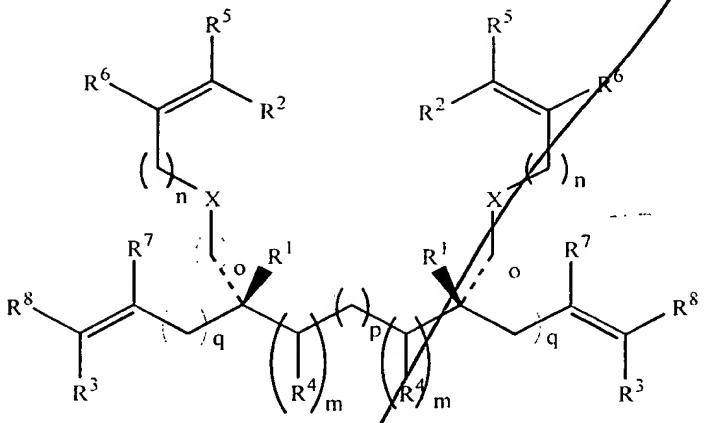
26. A method as in claim 1, wherein the molecular substrate comprises a structure:



wherein "1 ▌" and "2▌" can be the same or different and each of "1 ▌" and "2▌" denotes a bond selected from the group consisting of a double bond and a triple bond; X and Y can be the same or different and each is a functional substituent; a, b, d and e can be the same or different and each of a, b, d and e are integers equaling 0 to 1; m, n, o, p and q can be the same or different and each of m, n, o, p and q are integers equaling 0-20; A, B, D, E and R^1 - R^4 can be the same or different and each of A, B, D, E and R^1 - R^4 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

27. A method as in claim 26, wherein X and Y are selected from the group consisting of CR^9R^{10}, carbonyl, ester, SiR^9R^{10}, $OSi(R^9)(R^{10})$, SnR^9R^{10}, B, O, S, Se, NR^9, PR^9 and PO_3R^9; R^9 and R^{10} can be the same or different and each of R^9 and R^{10} is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

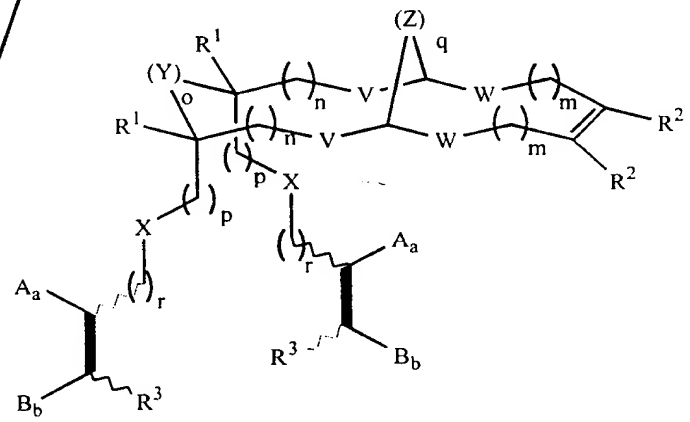
28. A method as in claim 26, wherein the molecular substrate comprises a structure:



wherein R^5 - R^8 can be the same or different and each of R^5 - R^8 is a selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl, wherein C_1-C_{20} alkynyl are hydrocarbons optionally interrupted a functional group including at least one non-carbon element.

29. A method as in claim 28,wherein X is selected from the group consisting of CR^9R^{10}, carbonyl, ester, SiR^9R^{10}, $OSi(R^9)(R^{10})$, SnR^9R^{10}, B, O, S, Se, NR^9, PR^9 and PO_3R^9; R^9 and R^{10} can be the same or different and each of R^9 and R^{10} is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

30. A method as in claim 1, wherein the molecular substrate comprises a structure:

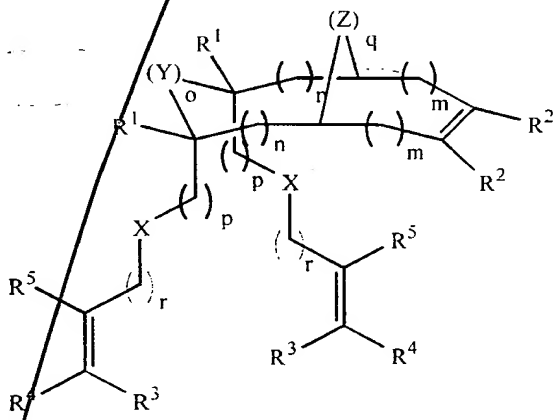


wherein "▮" denotes a bond selected from the group consisting of a double bond and a triple bond; V, W, X, Y and Z can be the same or different and V. W, X, Y and Z are functional

substituents; a and b can be the same or different and each of a and b are integers equaling 0 to 1; m, n, o, p, q and r can be the same or different and each of m, n, o, p, q and r are integers equaling 0-20; A, B and R^1 - R^3 can be the same or different and each of A, B and R^1 - R^3 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

31. A method as in claim 30, wherein each of V, W, X, Y and Z is selected from the group consisting of CR^6R^7, carbonyl, ester, SiR^6R^7, $OSi(R^6)(R^7)$, SnR^6R^7, B, O, S, Se, NR^6, PR^6 and PO_3R^6; R^6 and R^7 can be the same or different and each of R^6 and R^7 is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

32. A method as in claim 30, wherein the molecular substrate comprises a structure:



wherein R^4 and R^5 can be the same or different and each of R^4 and R^5 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

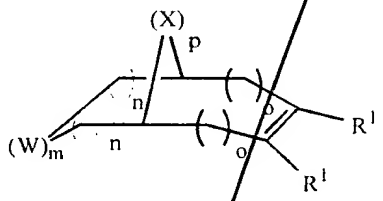
33. A method as in claim 32, wherein each of X, Y and Z is selected from the group consisting of CR^6R^7, carbonyl, ester, SiR^6R^7, $OSi(R^6)(R^7)$, SnR^6R^7, B, O, S, Se, NR^6, PR^6 and

PO_3R^6; R^6 and R^7 can be the same or different and each of R^6 and R^7 is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

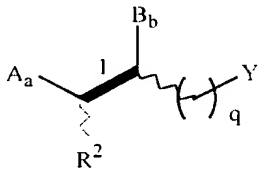
34. A method as in claim 1, wherein the olefin metathesis reaction is selected from the group consisting of ring-closing metathesis and ring-opening metathesis.

35. A method as in claim 1, wherein the molecular substrate is a first molecular substrate, the method further comprising a second molecular substrate and the olefin metathesis reaction is a cross-metathesis reaction.

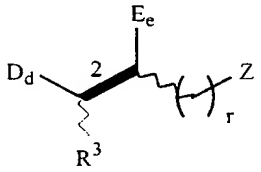
36. A method as in claim 35, wherein the first molecular substrate is selected from the group consisting of:



and



and the second molecular substrate comprises a structure:

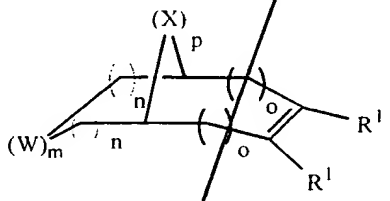


wherein "1┃" and "2┃" can be the same or different and each of "1┃" and "2┃" denotes a bond selected from the group consisting of a double bond and a triple bond; W and X can be the same or different and W and X are functional substituents; a, b, d and e can be the same or different and each of a, b, d and e are integers equaling 0 to 1; m, n, o, p, q and r can be the same or different and each of m, n, o, p, q and r are integers equaling 0-20; A, B, D, E and R^1 - R^3 can be the same or different and each of A, B, D, E and R^1 - R^3 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element; Y and

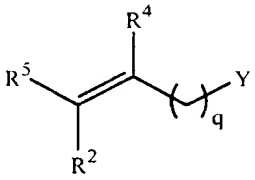
Z can be the same or different and each of Y and Z is selected from the group consisting of CN, carboxylic ester, amide, acid, halogen, hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted a functional group including at least one non-carbon element.

37. A method as in claim 36, wherein each of W and X is selected from the group consisting of CR^8R^9, carbonyl, ester, SiR^8R^9, $OSi(R^8)(R^9)$, SnR^8R^9, O, S, Se, NR^8, PR^8 and PO_3R^8; R^8 and R^9 can be the same or different and each of R^8 and R^9 is selected from the group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

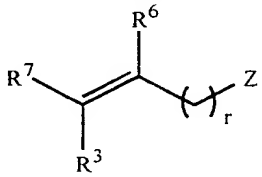
38. A method as in claim 36, wherein the first molecular substrate is selected from the group consisting of:



and



and the second molecular substrate comprises a structure:



wherein R^4 - R^7 can be the same or different and each of R^4 - R^7 is selected from the group consisting of hydrogen, hydroxy, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

39. A method as in claim 38, wherein each of W and X is selected from the group consisting of CR^8R^9, carbonyl, ester, SiR^8R^9, $OSi(R^8)(R^9)$, SnR^8R^9, O, S, Se, NR^8, PR^8 and PO_3R^8; R^8 and R^9 can be the same or different and each of R^8 and R^9 is selected from the

group consisting of hydrogen, C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl, wherein C_1-C_{20} alkyl, C_1-C_{20} alkenyl, C_1-C_{20} aryl and C_1-C_{20} alkynyl are hydrocarbons optionally interrupted by a functional group including at least one non-carbon element.

40. A method as in claim 1, wherein the product is formed at a turnover number of at least about 5, the product being at least one enantiomer formed in an enantiomeric excess of at least about 20%.

41. A method as in claim 40, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 50%.

42. A method as in claim 40, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 85%.

43. A method as in claim 40, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 90%.

44. A method as in claim 40, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 95%.

45. A method as in claim 40, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 99%.

46. A method as in claim 40, wherein two enantiomers are each formed in an enantiomeric excess of at least about 20%.

47. A method as in claim 46, wherein the two enantiomers are each formed in an enantiomeric excess of at least about 50%.

48. A method as in claim 46, wherein the two enantiomers are each formed in an enantiomeric excess of at least about 85%.

49. A method as in claim 46, wherein the two enantiomers are each formed in an enantiomeric excess of at least about 90%.

50. A method as in claim 46, wherein the two enantiomers are each formed in an enantiomeric excess of at least about 95%.

51. A method as in claim 46, wherein the two enantiomers are each formed in an enantiomeric excess of at least about 99%.

52. A method as in claim 40, wherein the turnover number is at least about 10.

53. A method as in claim 40, wherein the turnover number is at least about 25.

54. A method as in claim 40, wherein the turnover number is at least about 50.

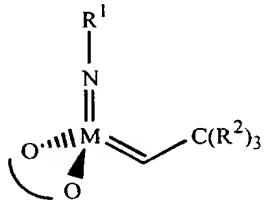
55. A method as in claim 40, wherein the turnover number is at least about 100.

56. A method as in claim 2, wherein the catalyst is a metal complex.

57. A method as in claim 56, wherein the metal complex is a transition metal complex including at least one metal-carbon double bond.

58. A method as in claim 57, wherein the metal complex is a transition metal dialkoxide complex.

59. A method as in claim 58, wherein the dialkoxide complex comprises a structure:



wherein the catalyst has a chiral dialkoxide ligand, denoted by  , the dialkoxide being of at

least 80% optical purity, M is a transition metal ion, and R^1 and R^2 can be the same or different, and each is selected from the group consisting of C_1-C_{12} alkyl, heteroalkyl, aryl, heteroaryl and adamantyl.

60. A method as in claim 59, wherein R^1 is selected from the group consisting of 2,6-dimethylphenyl, 2,6-diethylphenyl and 2,6-diisopropylphenyl and R^2 is selected from the group consisting of methyl, ethyl and phenyl.

61. A method for desymmetrization, comprising:

providing a catalyst and a molecular substrate having a plane of symmetry; and

allowing an olefin metathesis desymmetrization reaction to occur in the absence of solvent to form a product free of a plane of symmetry.

62. A method as in claim 61, wherein the catalyst is present in an amount of less than 15 mol%, relative to an amount of substrate.

63. A method as in claim 61, wherein the catalyst is present in an amount of less than 10 mol%, relative to an amount of substrate.

64. A method as in claim 61, wherein the catalyst is present in an amount of less than 5 mol%, relative to an amount of substrate.

65. A method as in claim 61, wherein the olefin metathesis reaction is selected from the group consisting of a ring-closing and a ring-opening reaction.

66. A method as in claim 61, wherein the molecular substrate is a first molecular substrate, the method further comprising a second molecular substrate and the olefin metathesis reaction is a cross-metathesis reaction.

67. A method as in claim 61, wherein the desymmetrization reaction causes at least one enantiomer of a product to form in an enantomeric excess of at least about 20% at a turnover number of at least about 5.

68. A method as in claim 67, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 50%.

69. A method as in claim 67, wherein the at least one enantomer is formed in an enantiomeric excess of at least about 85%.

70. A method as in claim 67, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 90%.

71. A method as in claim 67, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 95%.

72. A method as in claim 67, wherein the at least one enantiomer is formed in an enantiomeric excess of at least about 99%.

73. A method as in claim 67, wherein two enantiomers are formed in an enantiomeric excess of at least about 20%.

74. A method for catalytic desymmetrization, comprising:

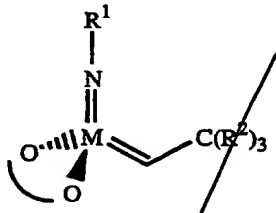
providing a molecular substrate having a plane of symmetry and a catalyst, the catalyst being present in an amount of less than 15 mol%, relative to an amount of substrate; and

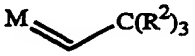
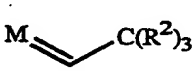
allowing a desymmetrization reaction to occur to form a product having a quaternary carbon center in at least about 20% enantiomeric excess.

75. A method as in claim 74, wherein the desymmetrization reaction is a carbon-carbon bond forming reaction.

76. A method as in claim 75, wherein the desymmetrization reaction is an olefin metathesis reaction.

77. A composition comprising a structure:



wherein M is a metal ion and  is a chiral dialkoxide of at least 80% optical purity, the dialkoxide having sufficient rigidity such that a  reaction site is of sufficient shape specificity, defined in part by the dialkoxide and a M=N=R site, to cause a molecular substrate having a plane of symmetry to react with a M=C center at the  reaction site, forming a catalytic olefin metathesis product that has at least a 50% enantiomeric excess of at least one enantiomer present in the mixture, the product being free of a plane of symmetry.

78. A method for performing a kinetic resolution, comprising:

providing at least one substrate having at least one olefin group, the substrate having a plane of symmetry;

selecting a catalyst of sufficient steric bulk to initiate an olefin metathesis desymmetrization reaction involving the at least one substrate to achieve a k_{rel} of at least about 10.

79. A method as in claim 78, wherein the reaction is selected from the group consisting of a ring-opening metathesis reaction, a cross-metathesis reaction and a ring-closing metathesis reaction.

80. A method for performing an asymmetric olefin metathesis reaction, comprising:

providing a substrate comprising at least one olefin group associated with a ring structure, the substrate having a plane of symmetry;

reacting a catalyst with the substrate to initiate an olefin metathesis desymmetrization

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reaction to achieve a k_{rel} of at least about 5.

81. A method as in claim 80, wherein the reaction further comprises a kinetic resolution.

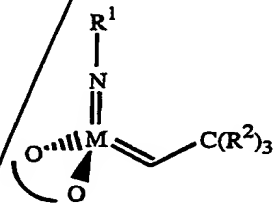
82. A method for performing an asymmetric olefin metathesis reaction, comprising:

providing two substrates, at least one substrate having a place of symmetry and each substrate containing at least one olefin group;

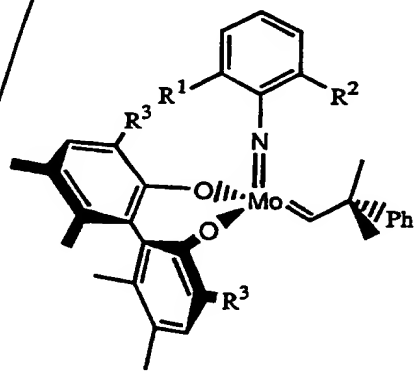
reacting a catalyst with the substrates to form a product free of a plane of symmetry having an enantiomeric excess of at least about 50%.

83. A method as in claim 82, wherein the reaction is selected from the group consisting of a ring-opening metathesis reaction, a cross-metathesis reaction, kinetic resolution and a combination thereof.

84. A method as in any one of claims 78, 80 or 82 wherein the catalyst comprises a structure:



85. A method as in claim 84, wherein the catalyst comprises a structure:

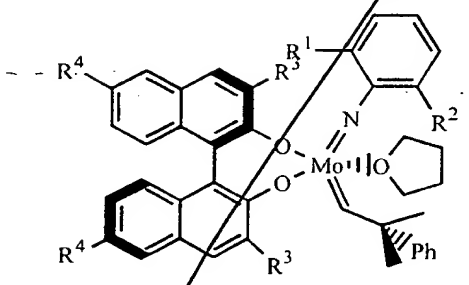


wherein R^1 - R^3 can be the same or different and each is selected from the group consisting of hydrogen, alkyls, aryls, alkaryls and substituted derivatives thereof.

86. A method as in claim 85, wherein R^3 is selected from the group consisting of ethyl, *i*-Pr, *t*-Bu and adamantyl and R^1 and R^2 selected from the group consisting of i-Pr and methyl.

87. A method as in claim 85, wherein R^1 is CF_3 and R_2 is hydrogen.

88. A method as in claim 84, wherein the catalyst comprises a structure:



wherein R^1 - R^4 can be the same or different and each is selected from the group consisting of hydrogen, alkyls, aryls, alkaryls and substituted derivatives thereof.

89. A method as in claim 88, wherein R^3 is selected from the group consisting of 2,4,6-tri(*i*-propyl)phenyl, phenyl and *t*-Bu, R^1 and R^2 are selected from the group consisting of i-Pr and methyl and R^4 is selected from the group consisting of hydrogen and *t*-Bu.

90. A method as in claim 88, wherein R^1 is CF_3 and R^2 is hydrogen.